PHOTOMETRIC MONITORING OF NEAS OBSERVED IN RADAR.

M. Ferrais[1], E. Jehin[2], M. Devogèle[1], F. Venditti[1], S. Marshall[1], L. Zambrano Marin[1], Anna McGilvray[1], Z. Benkhaldoun[3], [1]Arecibo Observatory/University of Central Florida (HC-3 Box 53995, Arecibo, PR 00612, USA; marin.ferrais@ucf.edu), [2]Space sciences, Technologies & Astrophysics Research (STAR) Institute University of Liège (Allée du 6 Août 19, 4000 Liège, Belgium), [3]High Energy Physics and Astrophysics Laboratory, Cadi Ayyad University (Marrakech, Morocco).

Introduction: We are acquiring photometric observations of near-Earth asteroids (NEAs) which support shape modelling using radar data as well as an effort to calibrate the relation between the albedo and the polarization displayed by NEAs.

Shape modelling with radar. Photometry is a necessary complement to radar data as it allows for observations during longer periods of time and at a wider range of phase angles than in radar, which is of great importance for spin axis determination and shape modelling purposes. We are supporting shape modelling efforts using archive radar data from the Arecibo Observatory and/or observations from the Goldstone observatory.

Albedo-polarization relationship. The degree of linear polarization of the light scattered by an asteroid surface is dependent on its albedo at first order [1]. High albedo results in low polarization and vice versa. We are currently acquiring polarimetric data of NEAs with $V < 15$ with the ToPol instrument at the Calern Observatory in France [2] to calibrate this relationship for the first time for NEAs at high phase angles. Such calibration will provide a strong tool to determine the albedo of a given NEA, thus its size, from a single polarimetric observation at phase angle > 40°. As we also need to refine, or determine for the first time, the albedo of our targets, we use photometric lightcurves to help determine the spin axis orientation, thus the size of the objects thanks to the radar data, and observations at low phase angles to construct phase curves that allows to refine the absolute magnitude H.

Observations: Observations are conducted with the robotic telescopes TRAPPIST-North (TN, Z53) and TRAPPIST-South (TS, I40) of the Liège University, located at the Oukaïmeden Observatory in Morocco and the ESO La Silla Observatory in Chile, respectively [3]. Both are 0.6-m Ritchey-Chrétien telescopes operating at f/8 and about 25% of their observation time is dedicated to this program. For targets close enough to the equator, it is possible to make use the 63° of longitude difference between the two observatories to extend the observation time by observing first with TN and then with TS.

Methods: Standard procedures and corresponding flat fields, bias and dark frames are used to calibrate the raw images. The differential photometry is performed using Python scripts while the absolute calibration in the Johnson-Cousins R band is done with the Photometry pipeline [4].

Results: We have so far observed 55 different NEAs for which there exists radar data from Arecibo and/or Goldstone and we possess polarimetric data for 25 of them. Since 2017, we acquired a dense lightcurve for each object for one or several apparitions, complemented with color data using the B, V, R, and I Cousins filters and short observations at low solar phase angles when necessary. Examples of shape modelling making use of the TRAPPIST data include 2005 UD [5] and 1998 OR2 [6]. We will present the data obtained so far and preliminary results concerning a shape model of 1994 AW1.

References: [1] Belskaya, I. et al. (2015) *Asteroids IV*, 151–163. [2] Devogèle, M. et al. (2017) *MNRAS, 465*, 4335–4347. [3] Jehin, E. et al. (2011) *The Messenger, 145*, 2–6. [4] Mommert, M. (2017) *Astronomy and Computing, 18*, 47-53. [5] Kueny, J. K. et al (2023) *PSJ, 4*, 56. [6] Devogèle, M. et al. (2023) *PSJ*, submitted.